

ABSTRACT OF THE DISCLOSURE

An apparatus for generating a quantum state of a two-qubit system including two qubits, each qubit being represented by a particle which invariably travels through one of two paths, includes a quantum gate composed of an interferometer for implementing an interaction-free measurement. The apparatus receives two particles having no correlation and generates a Bell state with asymptotic probability 1. A Bell measurement of a state of a two-qubit system is performed by observing a quantum gate composed of the interferometer after the quantum gate has processed the state and selecting the state from the Bell bases. An approximate fidelity of a quantum gate composed of the interferometer is calculated, if an absorption probability with which a first particle absorbs a second particle in the interferometer is less than 1, under the condition that the number of times the second particle hits beam splitters in the interferometer is sufficiently large.